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Name of Principal Author and all other author(s): Joseph M. Olah

Principal Author's Organization and address: 500 Edgewood Road, Suite 205, Edgewood, MD 21040

Phone: 410-679-1612 Email: Olah@stcnet.com

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# **Practical Verification and Validation (V&V) of System of Systems (SoS) Federations for the Future Combat System (FCS)**

Joseph M. Olah  
FCS MSO IV&V Team Member

Reviewed by Jeff Pierson  
FCS MSO IV&V Team Leader

Science Technology Corporation (STC)  
500 Edgewood Road, Suite 205  
Edgewood, MD 21040  
410-679-1612



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# Topics

1. Point of View
2. Theory vs. Reality
3. Definitions & Points
4. V&V Concepts
5. Tasks of Federation V&V
6. Scope
7. Layers of V&V
8. Standard & Metrics of V&V
9. Summary of the V&V Strategy



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# Point of View

- Look at objective (mitigating risk) instead of activities.
- Assumption: A proper V&V program will assure a suitable federation for a test event.
- Interpretation of old concepts.
- Auditing of V&V.



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# V&V: Theory vs Reality

- Theory
  - Well defined development process
  - V&V started before development
  - V&V team integrated into development process
  - V&V ensures right product built correctly
- Reality
  - Development process ill-defined
  - V&V is afterthought
  - V&V team small and on outside
  - V&V is an administrative exercise



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# Definitions & Points

- V&V
- Simulation vs. Software Application
- Federation (Capability & Event)



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# V&V Concepts

- Collecting Evidence
- V&V follows federation development
- V&V is continuous





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# Tasks of Event Federation V&V

- First
  - Identify sponsor, integrator, and user
  - Find objective of event & intended use of federation
  - Find what V&V is already happening
- Then
  - Confirm Requirements are appropriate
  - Confirm Design traces to requirements
  - Confirm Implementation uses best practices
  - Confirm federation works and is reliable



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# Scope

- Analogy: Buying a Car
- Start at top level
- Data Source Requirements
- Simulation over Software Applications
- Think out Assumptions to logical conclusions



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# Layered V&V

- Layers
  - Data
  - Simulations / Software Applications
  - Capability Federations
  - Event Federation
- Relationship
  - One of helpfulness (assist, advise, assess)
  - Not demand tasks not in contract



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# Standard & Metrics of V&V

- Standard
  - Sufficient Evidence of Proper V&V
- Metrics
  - Federation & developing organization identified
  - Federation Conceptual Model described
  - Federation assumptions & limitations are specified
  - Integration folks and V&V agents identified
  - SoS V&V methods are listed & described
  - The V&V results are summarized



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# Summary of V&V Strategy

- Tasks
  - Find event federation decision makers
  - Find event objective and intended use of the federation
  - Find who is doing V&V; build relationship
  - Confirm: Requirements harmonized, Design traceable, Implementation efficient, and Federation reliable
- Point of View
  - Keep eye on objective of V&V
  - Look at top level of event federation.
  - Concentrate on simulations as opposed to software applications
  - Collect evidence of V&V – not documents.
  - Build picture of V&V status (continuous process).
  - Ensure activities lead to reduction in risk (V&V objective).

